

Progress Report #3 (June 20, 2011 to July 1, 2011)

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Internship Mentor: Dr. Robert Howard

Introduction

The purpose of this progress report is to summarize and evaluate the work accomplished during my internship period and compare it to my proposed goals.

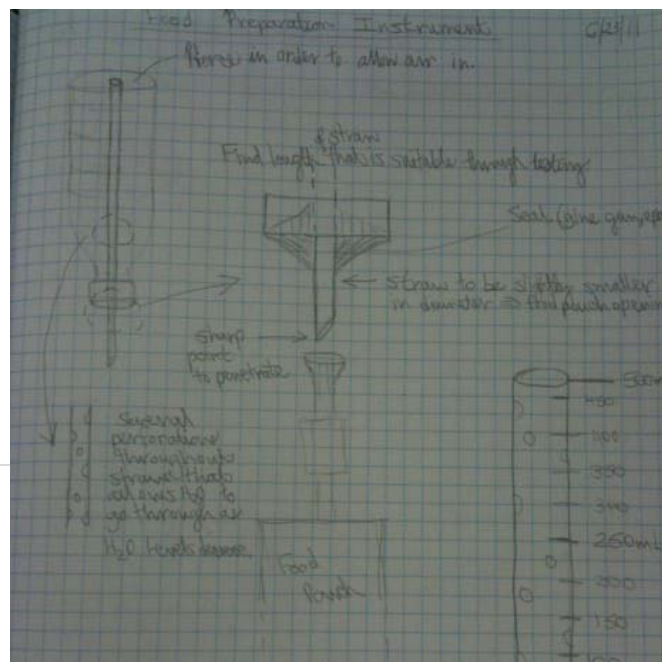
Tasks

Throughout this time period, I have worked on 2 designs for Desert RATS. At the analog site, the crew will use the same food pouches that are used aboard the ISS. However, the crew faces an obstacle as there is no hydration machine at the site. In order to hydrate the food pouches, I have been tasked with designing a device that can be attached to commonplace disposable water bottles allowing for the hydration of food. The device must penetrate the designated opening on the food pouch. The hydration device must be interchangeable between water bottles and it must display the amount of water being dispensed. My design is inspired by measurement devices used in laboratories reminiscent of a graduated cylinder. A stiff cylinder (resembling a straw) will penetrate a water bottle cap. The cylinder will be perforated and have several key markings that illustrate the amount of water dispensed. The diameter of the cylinder must be small and close to the size of the food pouch opening.



Figure 1. (a) Standard food pouch that will be used throughout Desert RATS (b) Close-up of the opening

(c) Concept drawing of food pouch hydration device



Throughout the Desert RATS mission, the crew must exercise daily and with the same vigor as if they were in space. The exercise equipment includes the ergometer and the Advanced Exercise Concepts Crew Exploration Vehicle (AEC CEV). My task is to develop a method to attach the equipment to the HDU's 2nd floor without drilling or cutting into the floor. My design uses Velcro for the initial attachment point and is then followed by a 1/2" 3031 Aluminum base plate and supporting brackets. The actual exercise equipment is very heavy (10 lbs or more) and the design will require thorough testing in order to achieve an even distribution of loads.

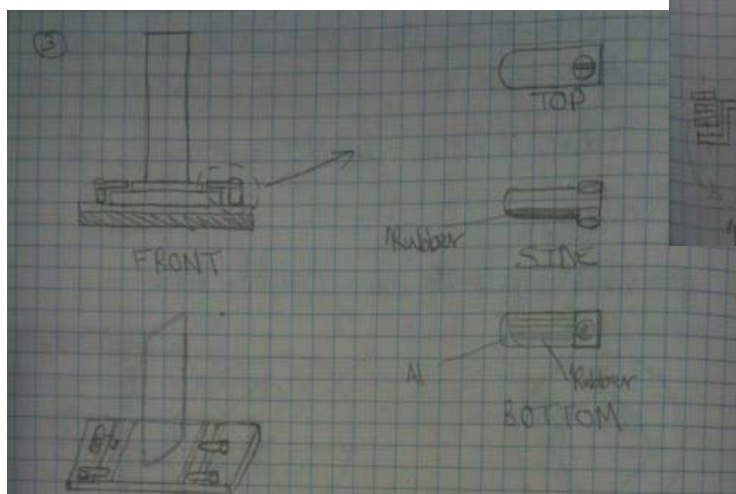
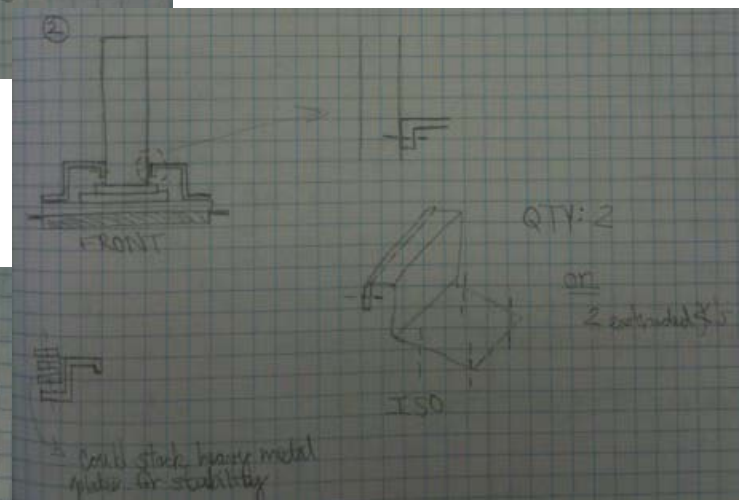
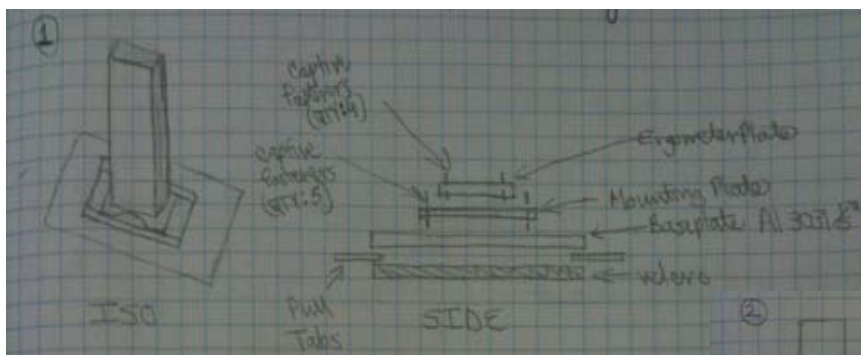


Figure 2. (a) Ergometer



(b) AEC CEV exercise device

(c) Concept drawings for stability devices



I have continued improving the design for the DSH. The DSH contains workstations for experiments and serves as the habitation facility for the astronauts going on long duration space flights outside of LEO. DSH has docking and crew transfer possibilities between various vehicles including the Cryo-Propulsion Stage (CPS), Solar Electric Propulsion (SEP), Space Exploration Vehicle (SEV), and Multi Purpose Crew Vehicle (MPCV). It will be able to dock with the SEP. The DSH itself will not conduct the docking to other elements. The attitude control for automated rendezvous and docking will be done by the CPS or a combination of the CPS and the MPCV.



Figure 3. DSH Concept

Schedule

In order to optimize the internship period I have discussed with a member of the team on several activities in which I can participate. The following GANTT chart provides a rough outline of the internship period.

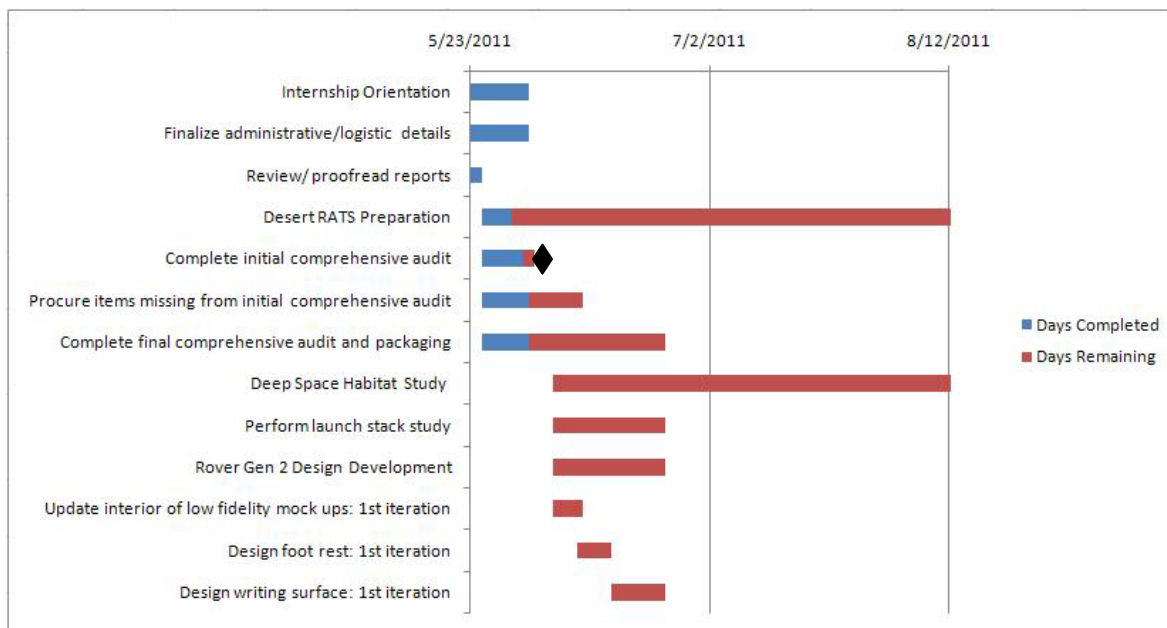


Figure 5. Proposed Schedule

The first milestone ♦ indicates the completion of the initial comprehensive audit and brings about the new procurement phase. This will allow for all missing items to be bought, organized, packaged, and then be stored in the carts to be used during Desert RATS.

Conclusion

The next major task is to develop the concept for Deck 2 of the Vertical Orientation DSH. This will require focusing on 2 work stations in CAD. I am interested in developing the biological, medical, and exercise workstations. This will require working with experts from each of these subsystems and receiving their input and suggestions. In turn, I will return a product and continue the iteration process. I have started extracting important design considerations from the Habitable Volume Summary Update, Waste Hygiene Summary Update, and the Constellation program Human-Systems Integration Requirements (HSIR) documents and will continue to refer to them throughout the project.